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Effects of time spent on pasture on milk yield, body reserves, herbage intake and grazing behaviour

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SUMMARY – A two year experiment was carried out to study the effect of the time spent on pasture on milk yield and quality, body reserves, intake and grazing behaviour in dairy ewes. Access time to pasture was either restricted to 4 hours (4H) or 7 hours (7H). Grazing management affected the total time spent grazing spending more time the 7H groups (222 vs 184 min/day) but less efficiently in terms of time spent grazing per hour (37 vs 42 min/h). Grazing management affected neither herbage intake (1159 vs 976 g DM) nor total daily intake (1915 vs 1801 g DM). On the other hand it affected milk yield (942 vs 916 ml/day) and milk quality with higher yields for the 7H groups but with lower milk fat (7.9 vs 8.2%) and protein contents (5.5 vs 5.6%) resulting in non significant differences in terms of standard milk production. Grazing management influenced body reserves. The highest body weights (64.7 vs 63.4 kg) and body condition scores (3.24 vs 3.16) were obtained with the 7H-treatment.

Keywords: Dairy ewes, time at pasture, milk production, intake.

RESUME *– "Effets de la durée de pâturage sur le rendement en lait, les réserves corporelles, l'ingestion d'herbe et le comportement sur parcours". Une expérience de deux années a été menée pour étudier l'effet du temps en pâturage sur la quantité et la qualité du lait produit, les réserves corporelles, l'ingestion et le comportement en pâturage des brebis laitières. Le temps en pâturage a influencé le temps total de pâturage réel. Les animaux qui passent plus de temps en pâturage (7 heures) pâturent plus que ceux qui ont passé 4 heures sur parcours (222 vs 184 min/jour). Le temps en pâturage n'affecte de manière significative ni l'ingestion d'herbe (1159 vs 976 g MS) ni l'ingestion totale (1915 vs 1801 g MS). Il a par contre affecté la production laitière qui a été plus élevée chez les brebis qui ont pâturé pendant 7 heures (942 vs 916 ml/jour). Le lait produit par les brebis soumises au traitement 7H a des taux de matières grasses (7,9 vs 8,2%) et de protéine (5,5 vs 5,6%) plus faibles que celui obtenu avec les brebis qui ont passé moins de temps sur parcours. Le poids vifs (64,7 vs 63,4 Kg) et l'état corporel (3,24 vs 3,16) ont été plus élevés chez les animaux qui ont passé plus de temps sur parcours (7H).*

Mots-clés : *Brebis laitières, durée de pâturage, production laitière, ingestion.*

Introduction

In the Basque country, the sheep milk production system is very important from a social point of view as most of the milk produced is processed into high quality cheese. Although this milk production system is based on a high pasture utilisation, natural resources available to livestock are scarce. Shepherds manage these resources carefully trying to match herbage, forage and supplement availability with production necessities. This is achieved by a rationed grazing system where ewes spend between 3 and 7 hours outdoors (Oregui *et al.,* 1997). Rationed grazing is often used at the beginning of the grazing when weather conditions are often bad and forage is available in limited quantities. Under these harsh conditions, animals should receive high value supplements, which are expensive and sometimes not easily available at farm gate (Molle *et al.,* 2002). Therefore, pasture is another component of the ration, which interacts with the forage and supplements given indoors.

This production system, which is typical of the Mediterranean area, is different from that in northern Europe where continuous grazing is the typical management. Since most of the research has been done under those conditions, there is a lack of information concerning animal performance in this rationed grazing system. Therefore, the purpose of this study is to evaluate the influence of restricted access to pasture on milk production, body reserves, grazing behaviour and intake.

Materials and methods

Experimental site

The experiment was conducted at Neiker Research Station, Spain (42º51' North, 2º37' West), at an altitude of 520 m above sea level. The swards were permanent pasture where ryegrass (*Lollium perenne*) and white clover (*Trifolium repens*) were the predominant species.

Animals and experimental design

The experiment was conducted over 8 weeks during the spring of two consecutive grazing seasons (2000 and 2001). In both years, 48 multiparous Latxa dairy ewes were blocked into groups of 12, on the basis of lactation number, days in lactation, milk yield and body weight so that groups were homogeneous. Initial mean values for milk yield, fat content, protein content, body weight and body condition score (BCS) for both years were 1333 and 1307 ml, 6.5 and 7.1%, 5.1 and 4.9%, 62.5 and 68.4 kg, and 2.7 and 3.3. Blocks were randomly assigned to one of the following experimental treatments: (i) 4 hour-access to pasture (4H); or (ii) 7 hour-access to pasture (7H).

Each group had access to a different paddock after the morning milking. When not on pasture, groups were housed separately in a free stall barn where they had free access to water. During each milking, ewes were offered half of their daily allowance (263 g DM) of supplement, which was formulated to be isoenergetic and isoproteic (Table 1). A sample of the offered concentrate was taken every time a new concentrate bag was opened. After the afternoon milking ewes were fed 500 g DM of grass silage in year 2000. However, in year 2001, 4H and 7H groups were fed 300g DM and 250 g DM respectively. Grass silage was weighted individually for each ewe and placed in troughs. Orts were measured the following day and bulked for each group. A sample of the offered grass silage was taken everyday and bulked for each week. The chemical composition of grass silage is reported in Table 1.

Table 1. Chemical composition of feeds

	Grass silage		Herbage		Concentrate[†]	
	2000	2001	2000	2001	2000	2001
DM (% fresh matter)	72.5	36.4	27.0	24.0	88.5	89.2
OM (% DM)	89.9	90.7	89.7	90.2	94.2	93.3
ADF (% DM)	35.5	45.0	26.7	29.9	8.6	8.4
CP (% DM)	17.3	12.6	20.6	18.3	19.5	20.8
OMD (%)	57.9	56.6	65.7	61.4	83.9	84.0

[†]Contained 48.5% barley, 9.7% corn, 19.6% soybean meal, 19.5% pulp, 1.2% molasses, 1.4 mineral salts (% DM)

Measurements and samplings

Sward height was estimated twice weekly using a swardstick from 35 measurements taken at random in each plot. Sward heights were maintained between 6 and 8 cm by moving the electrical front fence.

Milk yields, body weight and BCS were recorded once a week. The concentration of fat and protein were determined from one successive morning and afternoon milk sample taken each week. Standard milk production was calculated as described by Bocquier *et al.* (1993).

Intakes of grass at grazing were estimated dosing Cr_2O_3 gelatine capsules containing approximately 1 g Cr. Herbage intake was estimated in three periods (weeks 2, 5 and 8) in 2000 and in two periods (weeks 2 and 5) in year 2001. All ewes were dosed twice daily after morning and

afternoon milking. To ensure that stable conditions were reached prior to sampling the faeces, a preliminary dosing period of seven days was performed. Faecal grab samples were collected twice daily during three consecutive days at milking time. Faecal samples for each ewe and each period were bulked and stored at -20ºC prior to drying. Samples of herbage were collected by hand-plucking to simulate grazing from each plot during the same week that faecal sampling took place. Grass silage and herbage *in vivo* OM digestibility were estimated by means of the gas production technique using the equations proposed by García-Rodríguez *et al.* (2003) and Chenost *et al.* (2001), respectively. Concentrate *in vivo* OM digestibility was estimated according to Giger-Reverdin *et al.* (1990). During this faecal sampling period the quantity of concentrate rejected was also measured for each ewe. Concentrate and grass silage intake was measured as the difference between the quantities offered and rejected.

Animal behaviour was recorded twice a week every fifteen days. Observations were recorded continuously during the time animals had access to pasture. To measure grazing activity the number of ewes engaged in grazing was recorded every five minutes. To estimate bite rate, the number of bites taken in periods of time longer than 1 minute were measured.

Chemical analyses

Grass silage, herbage, concentrates and faeces were dried at 60ºC for 48 h to determine DM content and milled to pass a 1 mm screen. Grass silage, herbage and concentrate were analysed to determine their chemical composition. Ash and organic matter (OM) concentrations were measured by igniting samples in a muffle furnace at 550ºC overnight. CP was determined by the Kjeldahl procedure (Nx6,25), while the cell wall constituents (ADF) were analysed on a Fibersac extraction unit (Ankom, US) as described by Van Soest (1982). Faeces were analysed for Cr by atomic absorption spectrophotometry. The protein and fat concentrations in milk were measured with an infra-red analyser (Milkoscan, Foss Electric, Hillerod, Denmark).

Statistical analyses

The milk yield, milk composition, body weight, BCS, DM intake and grazing time were subjected to analysis of variance by the general linear model (GLM) procedure of SAS (1988) taking the data used to make the experimental groups as covariates.

Results and discussion

Animal behaviour

The time spent grazing was longer in the groups that had a 7H-access to pasture (222 vs 184 min/day, $P<0.001$). The 4H groups used the time spent on pasture in a more efficient way spending 47 min/h in comparison with the 32 min/h used by the 7H groups ($P<0.001$).

In terms of grazing time per hour spent on pasture (Fig. 1) both groups spent most of the first hour grazing. However, during the rest of the hours, the 4H group maintained higher grazing time compared with the 7H group.

In some way the animals learn that they can only stay a limited number of hours on pasture and modify their grazing behaviour accordingly. As a consequence, whereas the 7H groups take longer resting times resulting in a more constant grazing pattern along the day, the 4H groups graze more intensively and efficiently but not enough as to account for all the difference on access time. However, this grazing behaviour can only be achieved if ewes are managed in a very constant way.

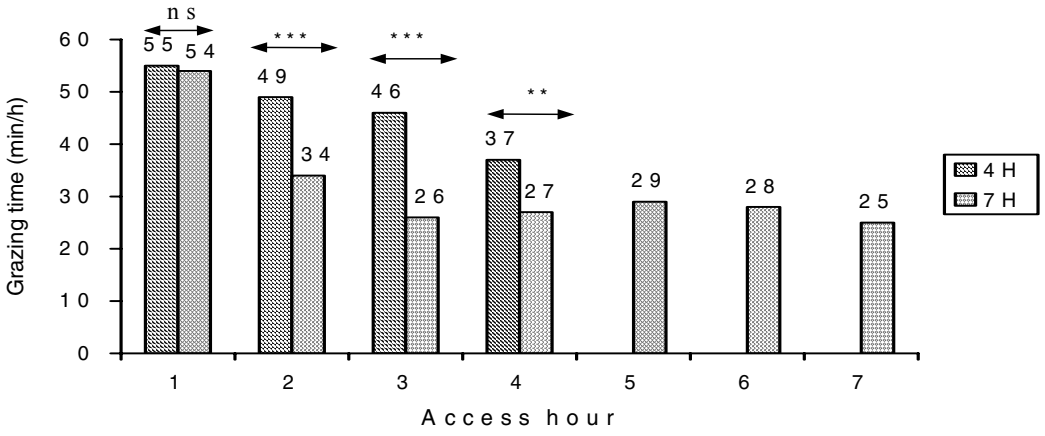

Fig. 1. Grazing behaviour of ewes with limited access time (4H or 7H) to pasture *P<0.05; **P<0.01; ***P<0.001.

Intake

Although the 7H groups grazed during a longer time, herbage intake (976 vs 1159 g DM/day; P>0.05) was similar between the two treatments (i.e. 4 H and 7 H). The 4H groups ate more grass silage (373 vs 334 g DM/day; P<0.05). As a result there were not significant differences in terms of total dry matter intake (1801 vs 1915 g DM/day; P>0.05). Therefore, animals with a restricted access to pasture compensate this time restriction with a higher intake rate and a higher indoor supplement intake reaching similar total dry matter intakes. However, this compensation takes place by substituting herbage by grass silage of lower quality. As a consequence, the OMD in 7 H-ewes was 7.7% higher than that obtained by the 4H treatment (62.2 vs 67.0%) leading to a 13% higher metabolic energy intake (19.0 vs 21.6 MJ/day).

Production data

The average milk yield, standard milk production and milk composition for each group and week of experience is shown in Fig. 2.

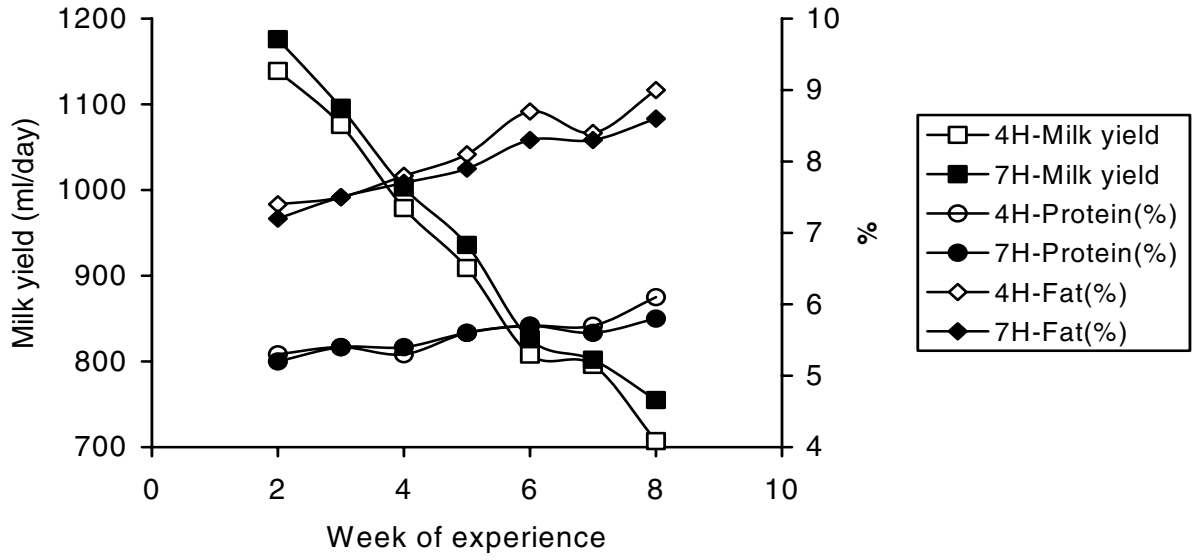

Fig. 2. Evolution of the milk yield, milk protein content and milk fat content depending on the time spent on pasture (4H or 7H).

Time spent on pasture had a significant effect on milk yield ($P<0.05$), milk protein content ($P<0.05$), milk fat content ($P<0.001$), body weight ($P<0.001$) and BCS ($P<0.05$) but not on the standard milk production. The 7H groups had higher milk yields (942 vs 916 ml/day) but lower milk protein (5.6 vs 5.5 %) and fat contents (8.2 vs 7.9 %) resulting in non-significant differences in terms of standard milk production (958 vs 945 ml/day).

The higher metabolic energy intake (13%) in the 7H groups resulted in a higher body reserve recuperation measured in terms of body weight (64.7 vs 63.4 kg) and BCS (3.24 vs 3.16). This fact could reflect a more positive energetic balance and could also be responsible for the higher milk fat content according to Cannas and Avondo (2002)

Conclusion

Under the dairy Latxa production system, time spent on pasture causes a significant modification in the grazing behaviour resulting in very poor differences in terms of milk yield or the standard milk production.

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